was first proposed by Sir John Evans in 1866, has therefore lately attracted the favorable consideration of some American glacialists, and in Europe has been championed by Nansen in his very interesting work, "The First Crossing of Greenland." This theory supposes that within so late a part of the earth's history as the Ice age, the north pole may have moved to the region of southern Greenland and returned, giving in the period of its digression glacial conditions for all the lands adjoining the North Atlantic Ocean, and the same for the antipodal, then south polar, portion of the globe. A small observed variation of latitude, discovered several years ago by German and Russian astronomers, seemed to give a foundation for this view, but within the past two years the brilliant investigations of Dr. S. C. Chandler, showing that these variations are of very small amount and in two short periods, one of fourteen and another of twelve months, while no appreciable secular change of latitude can be recognized, leave to us no basis for this theory of the cause of accumulation and disappearance of ice-sheets.

The third theory, which the writer believes to be applicable, sufficient and acceptable for all the observed facts of the Glacial period, attributing the ice-sheets to high altitude of the drift-bearing countries, has also been long under consideration, having been first suggested in 1855 by Dana, but failed until recently to receive adequate appreciation on account of the supposed geologic improbability of sufficiently high uplifts of so extensive portions of the earth's surface. During the past few years, however, this neglected theory has received full attestation by independent evidence, apart from the facts of glaciation, that these countries, and also other parts of the terrestrial coast, have been, in the same late geologic era which includes the Ice age, raised thousands of feet above their present height, to altitudes doubtless having so cool climate as to bring snowfall during nearly the entire year, the most favorable condition for the formation of ice-sheets. This evidence consists chiefly in the very great depth found by soundings in fjords and the submarine continuations of river valleys, where streams flowed formerly and eroded their valleys, showing these lands to have then stood far higher than now.

The Hudson River channel is traced somewhat more than a hundred miles out to sea, to a maximum depth of 2,844 feet. Similar depths are known by the United States Coast Survey and British Admiralty soundings, as Prof. J. W. Spencer has pointed out, for the former continuation of the Mississippi and St. Lawrence rivers and in the entrance of the Gulf of Maine, between Cape Cod and Nova Scotia. All about our northern and Arctic shores, from Maine around to Puget Sound, abundant fjords prove the land to have been formerly much elevated. On the coast of California, submarine valleys discovered by Professor George Davidson, of the U. S. Coast Survey, reach to depths of 2,000 to 3,120 feet; and Professor LeConte has shown that they are of late Tertiary and Quaternary age, probably contemporaneous with the submerged valleys of our Atlantic coast, and closely associated with the Glacial period. In the fluvial deposits of the Mississippi River, laid down while the ice-sheet was being formed, Professor E. W. Hilgard finds evidence that the interior of our continent northward, about the sources of the Mississippi, was then uplifted not less than 3,000 feet above its present height. Likewise the fjords of Scotland and its adjacent island groups, and especially the much deeper fjords of Scandinavia, prove for that glaciated region an altitude thousands of feet higher than now, the maximum depth of the Sogne fjord, the longest in Norway, being stated by Jamieson as 4,080 feet. In the same way, New Zealand and Patagonia, formerly glaciated, are remarkable for their abundant, long and branching fjords. But the most surprising known submerged continuation of any river valley is that of the Congo, which, according to Mr. J. Y. Buchanan, is determined, by soundings for a cable to connect commercial stations on the west African coast, to be about eighty miles long, descending to the profound depth of 6,000 feet below the sea level.

The Congo valley, only about four hundred miles south of the equator, proves that the epeirogenic uplifts, causing glaciation, were not limited to drift-bearing regions. Where the uplifted areas were in so high latitudes, both north and south, that their precipitation of moisture gave snowfall during all, or nearly all, the year, they began to be covered by snow, which became consolidated below into ice and grew in depth to hundreds and thousands of feet.

Why the earth during the Glacial period was extraordinarily deformed for comparatively short periods by great epeirogenic movements of elevation and correlative depression of other tracts, is a more fundamental and not less difficult question, for which I have attempted an answer in an appendix of Wright's "Ice Age in North America," ascribing these movements to stress stored up previous to its relief by the folding, overthrust and upheaval of mountain ranges. This explanation, although diverging widely from formerly assumed conditions of continental stability, seems yet well consistent with Dana's doctrine of the general permanence of the continents and oceanic basins.

NOTES ON THE DISTRIBUTION OF SOME OF THE CONIFERS OF NORTH-WESTERN CANADA.

BY J. B. TYRRELL, OF THE GEOLOGICAL SURVEY OF CANADA.

THE following observations on the limits of some forest trees were made while conducting geological surveys in the interior of northwestern Canada, in the country extending from Lake Winnipeg northwestward to the Athabasca River.

White Spruce (*Picea alba*) is the most important timber tree of this whole region. It occurs throughout the heavily wooded districts from Riding and Duck Mountains, in northern Manitoba, northwestward to the great forest region between the Saskatchewan and Churchill rivers, and thence westward beyond the Athabasca. North of the upper part of Churchill River it extends into the rocky granite country for a short distance and then disappears, so that its general northern limit is here reached at, or south of, the height of land; but while the writer was travelling across Little Hatchet Lake, in north latitude 58°40 and west longitude 103°45, a high sandy island was found on which was a small grove of tall white spruce, some trees with a diameter of fifteen inches. None others were seen anywhere in the vicinity. This grove, therefore, forms a little outlier in the surrounding scattered forest of small black spruce and Banksian pine, the hill of warm dry sand furnishing it with a sufficently congenial home. Extending in from the west the white spruce occurs on and around the shores of Lake Athabasca, but it does not appear to grow at any great distance back from the lake. Black Spruce (*Picea nigra*) is usually a smaller tree than the last, and is scattered on the low lands everywhere thoughout the forest regions of the Province of Manitoba, and the District of Saskatchewan, but north of the Churchill River, and southeast of Lake Athabasca it often ascends to the higher lands. Its northern limit for this region has not yet been traced. Balsam Fir (*Abies balsamea*) grows to a large size among the white spruce on the top and sides of the Duck Mountain in Manitoba, and between the Saskatchewan and Churchill rivers in the District of Saskatchewan. It

extends for a short distance north of the Chuchill River, where it appears to reach its northern limit.

Tamarac (*Larix Americana*) is found growing on the low wet land from the northern edge of the prairie region, northward as far as Lake Athabasca, but its northern limit has not yet been reached.

Cedar (*Thuya occidentalis*) has its general northwestern limit east of Lake Winnipeg, but an isolated colony occurs on the high ridge between Winnipegosis and Cedar lakes, two hundred miles distant from the general limit. No trace of cedar could be found in the intermediate country.

Red Pine (*Pinus resinosa*) also has its general northwestern limit some distance east of Lake Winnipeg, but an outlying grove is said to occur on Black Island, a large sandy island in the lake. Cones collected from trees on this island, and undoubtedly belonging to this species, were sent to the writer by Mr. A. Neison, of Badthroat River.

Scrub Pine (*Pinus banksiana*) grows on the high stony morainic hills on the northeastern portion of Duck Mountain, and on the sandy ridges to the north.

From here it extends northward and northwestward, keeping north of the heavy white spruce forest. It is the principal tree in the rocky and sandy region from the Churchill River northward to Black River, where it grows to a height of from twenty to forty feet, and to a diameter of from eight to twelve inches. On the more level sandy plains it here forms typical pine barrens, the trees being thinly scattered over the surface, while the land beneath them is quite devoid of undergrowth and there is little or no fallen timber, so that the whole country has a park-like aspect. On the rocky slopes it has taken root in the niches and crevices, and is usually stunted and very irregular. It extends north of Black River and Lake Athabasca, and its northern limit has not yet been traced.

THE AFFINITIES OF BASQUE AND BERGER.

BY CANON ISAAC TAYLOR, M. A., LL. D., LITT. D., YORK, ENGLAND.

In the Transactions of the Berlin Academy for June, 1893, Professor Von der Gabelentz has published a paper in which he endeavors to establish a connection between Basque and the languages belonging to the Berber family of speech, such as Kabyle and Tuareg. He admits that the results of his comparison are small, the languages differing in structure of speech, in gender, and in most of the formatives. But he urges that they had certain analogous laws of phonetic change, and that there is a resemblance in a few culture words, mainly the names of animals and of articles of dress. The paper is one of the numerous examples of the way in which pure philologists may be led astray by want of an adequate acquaintance with anthropology. The author bases his attempt on a recent paper in *Ausland* on the craniological resemblance between the Berbérs and the ancient Iberians. He then assumes that Basque represents the ancient Iberian speech, whereas Van Eys and Vinson, the two highest authorities, consider that it is impossible to explain such remains as we possess of the ancient Iberian by means of Basque. Broca, moreover, has proved that while the skulls of the Spanish Basques resemble, to some extent, those of the Iberians, the skulls of the French Basques belong to a different type. It is now believed that the race to which the French Basques belong imposed its language on the Spanish Basques, a feebler people of the Iberian type. If this is the case, the results obtained by Von der Gabelentz would be easy of explanation. A conquered people acquiring the language of their conquerors would retain their own phonetic tendencies, and at the same time would incorporate into the acquired language certain classes of words such as those which agree in Basque and Iberian, notably the names of articles of dress and of domesticated animals. In short, the ancient Iberian may have affected Basque much in the same way that Celtic has affected English and French. It has introduced sundry phonetic tendencies, and some loan words belonging to certain classes. Hence we may still hold fast to the old conclusion that the nearest affinities of Basque are with Accadian and the languages of the Ural-Altaic type.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

THE SO-CALLED SAND OF GREAT SALT LAKE.

The white deposit which covers Garfield Beach and the adjacent shore of Great Salt Lake, Utah, although commonly called sand, does not consist of true sand. An examination under a low magnifying power, such as that afforded by a common pocket lens, shows that all the particles or grains composing this so-called sand are very smooth and shiny, many being globular, others ovoid, and others dumb-bell and club-like in form. None of them present angular or irregular surfaces, and none have sharp edges or points. When treated with hydrochloric or nitric acid this oölitic "sand" rapidly dissolves with energetic effervescence, leaving but tiny little specks of silicious matter behind, which latter form nuclei in the centre of the oölitic grains. The solution thus obtained contains lime. A very careful scrutiny under high microscopic powers shows the most of each grain to consist of a white, fibrous or somewhat crystallized mineral, with a central enclosed bit of dark gray mineral, that which is left as silicious undissolved matter after the acid treatment aforesaid. In fact I have found a few grains containing nuclei so large that they could be readily seen by the unaided eye. It appears, therefore, that each grain of this deposit is a nodule or concretion, consisting of white crystalline calcite, containing a minute bit of silica or silicious matter as a central nucleus around which the calcite has collected. Some months ago Professor Rompletz reported traces of what he regarded as an alga in oölitic sand from the shores of Great Salt Lake. But Dr. George Jennings Hinde, F. G. S., of London, who has made recent examinations of samples of this oölitic "sand," writes me that he has not discovered any evidence of organic orgin in it. In all other respects Dr. Hinde's observations seem to agree with those made by me during the past year.

HENRY MONTGOMERY.

University of Utah, Salt Lake City, July 31.

NATURE'S ROTATION OF CROPS.

An open sandy field which the writer has passed several times a week, for the past ten years, has illustrated well this fact.

No record has been kept, but for the past five years, my recollection is accurate, and for a longer period, I am sure that the "crops" have been of the character stated, though the order of succession may not be strictly correct.

Seven or eight years ago there was a yield of *Œnothera biennis* which was phenomenal. The following year there was scarcely a plant of this species to be noticed, but a fine crop of mullein succeeded. Daisies followed the mullein, the next year daisies and golden rod (*S. nemoralis*). The year after the solidago took full possession and was a most magnificent crop. The year following but little golden rod could be seen, and very few daisies. Last year was the most magnificent crop of *Hypericum perforatum* I have ever seen. When in blossom, the field was one mass of solid color; it seemed the petals must touch